

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 35158F

Category: Operational Systems

Title: Satellite Data System (SDS)

Budget Activity: #5 Intelligence and Communications

RESOURCES/PROJECT LISTING/: (\$ in Thousands)

Project		FY 1976	FY 1977	FY 1978	FY 1979	Additional to	Total Estimated	
Number	Title	Actual	Estimate	Estimate	Estimate	Completion	Cost	
	TOTAL FOR PROGRAM ELEMENT	30,079	3,962	13,910	12,800	33,700	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT: The Satellite Data System (SDS) is a multipurpose, polar coverage communications satellite which will provide reliable and secure communications over the north polar regions. Operating in conjunction with the synchronous equatorial Fleet Satellite Communications (FLTSATCOM) satellites, the SDS completes the coverage required by the Air Force Satellite Communications (AFSATCOM) system for essential command and control communications for strategic forces.

BASIS FOR FY 1978 RDT&E REQUEST: This request includes funds for sustaining engineering support, initiating design and development activities to improve the anti-jam capabilities of the AFSATCOM payload on the sixth SDS satellite (F-6) and continuing the multi-year development efforts necessary to transition to the Space Shuttle. The Air Force has decided not to implement the interim capability anti-jam improvements previously planned in FY77 for the AFSATCOM payload on the fifth SDS satellite (F-5). This decision was influenced by the state of development for these improvements, the need to initiate procurement of the F-5 satellite in April 1977 and the relative priority of these improvements when compared to other Air Force requirements. As previously planned, the full capability anti-jam improvements will be made to the AFSATCOM payload on the F-6 satellite.

BASIS FOR INCREASE IN 1978 OVER 1977: Not applicable.

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DETAILED BACKGROUND AND DESCRIPTION: The Satellite Data System (SDS) will provide critical, transpolar, two-way, real-time command, control and communications for Strategic Air Command Single Integrated Operational Plan (SIOP) forces. Since a synchronous equatorial orbit cannot provide communications coverage over the polar region above 70 degrees North latitude, a highly inclined elliptical orbit was selected for the SDS. This orbit provides

The SDS is an integral part of the Air Force Satellite Communications (AFSATCOM) system which includes the Air Force Ultra High Frequency (UHF) communications capability on the synchronous equatorial Fleet Satellite Communications (FLTSATCOM) satellites, piggy-back transponders on selected host satellites and airborne/ground radio terminals. As such, the SDS will complement the FLTSATCOM satellite coverage by providing the requisite transpolar UHF coverage. Additionally, SDS will support the Air Force Satellite Control Facility (AFSCF) requirement for reliable, two-way, high data rate, S-band communications between the AFSCF remote tracking station at Thule, Greenland and the CONUS.

The direct benefits of SDS will be reliable and secure direct communications over the polar regions which will result in greatly improved command and control of SIOP forces, elimination of the dependence on vulnerable cables to the Thule station.

RELATED ACTIVITIES: The space segment of the FLTSATCOM will be developed, procured and launched under the FLTSATCOM Program Element, 33109N. The Air Force aircraft and ground UHF radio terminals required for operation with the FLTSATCOM and SDS satellites are funded within the AFSATCOM Program Element, 33601F. The AFSCF stations are funded under the AFSCF Program Element, 35110F.

WORK PERFORMED: Air Force Systems Command's Space and Missile Systems Organization, Los Angeles, California is responsible for the SDS. The prime contractor is Hughes Aircraft Company, El Segundo, California. General Systems Engineering and Integration is performed by the Aerospace Corporation, El Segundo, California.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1976/TQ and Prior Accomplishments: The technology phase of the program was completed in FY 1971. This was followed by a contract definition phase in FY 1972 which established the system configuration. The system acquisition contractor was selected by competitive source selection and a system development contract was awarded in June 1972. The system Critical Design Review (CDR) was successfully completed in March 1974 with all critical specifications being met or exceeded. The structural (X-1) and qualification (Y-1) model spacecraft and the initial flight vehicle (F-1) were procured incrementally with Research, Development, Test and Evaluation (RDT&E) funds. A production option to the development contract was exercised in FY 1974. This option provided for the fabrication, assembly,

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and test of the first production model spacecraft (F-2) and a backup flight vehicle (F-3). The development and production schedules were phased to achieve the required delivery, launch and system operational dates. Communications subsystem engineering models were completed and tested in November 1973. The structural model satellite testing was finished in May 1975. A qualification model satellite was built and tested to fully qualify the satellite prior to production. S

— All payloads were fully checked out on-orbit

2. FY 1977 Program: Initial Operational Capability was declared for all payloads — — after successful on-orbit checkout. Primary activities in FY 1977 include sustaining engineering support; design and development efforts to transition follow-on satellites to the Space Shuttle and reliability improvement activities. The Qualification Model Satellite (Y-1) will be refurbished and will become the fourth satellite (F-4). A continuing replenishment launch capability will be maintained in case of on-orbit satellite failures. S

3. FY 1978 RDT&E Planned Program: Primary efforts will include sustaining engineering support, initiating design and development efforts to improve the anti-jam capabilities of the Air Force Satellite Communications (AFSATCOM) System payload and continuing the development engineering necessary to transition follow-on satellites to the Space Shuttle. A continuing replenishment launch capability will be maintained in case of on-orbit satellite failures.

4. FY 1979 Planned Program: The FY 1979 plan is to continue sustaining engineering support, continue development of the anti-jam improvements for the AFSATCOM payload and continue the development efforts related to Space Shuttle transition. A continuing replenishment launch capability will be maintained in case of on-orbit satellite failures.

5. Program to Completion: This is a continuing program. As an integral part of the Air Force Satellite Communications (AFSATCOM) System, the program will continue to provide critical communications coverage and be totally compatible with the AFSATCOM aircraft and ground radio terminals. Sustaining engineering support will be required to maintain design compatibility; to incorporate improvements for survivability, reliability and to provide additional replenishment spacecraft. S

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6. Milestones:

	<u>Date</u>	<u>Estimated Cumulative RDT&E Cost to Reach Milestones (\$ in Thousands)</u>
A. System Preliminary Design Review	Mar 73	49,600
B. System Critical Design Review	Mar 74	96,600
C. Final Integrated Systems Test		
D. Launch First Spacecraft		
E. Launch Second Spacecraft*		
F. Initial Operational Capability		

*Subsequent launches will be on a replenishment basis as necessary to

7. Resources: (\$ in Thousands)

	<u>FY 1976</u>	<u>FY 1977</u>	<u>FY 1978</u>	<u>FY 1979</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RDT&E: Funds	30,079	3,962	13,910	12,800	33,700	Continuing
Quantities						Not Applicable
First Flight Satellite						1*
T-IIIB/Agna Launch Vehicle						1*

*During the development period, one satellite and one launch vehicle were procured.

Missile Procurement:

Funds	7,800	13,400	59,400	83,200	26,100
Quantities					
Flight Satellites			1**	1	
T-IIIB/Agna Launch Vehicles			1 ^T	1 ^A	1 ^I

**Qualification model (originally procured with RDT&E funds) refurbished to become fourth satellite (F-4).

T T-IIIB launch vehicle for fifth satellite (F-5).

A Agna upperstage launch vehicle for F-5.

I Interim Upper Stage for planned launch of F-6 satellite on the Space Shuttle

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TEST AND EVALUATION DATA:

1. Development Test and Evaluation: The development contractor for the Satellite Data System (SDS) is Hughes Aircraft Company, El Segundo, California. The first satellite was launched Initial Operational Capability was established. The first satellite (F-1) was funded entirely within the development program. The second satellite (F-2) was the first vehicle funded under the production program. The development hardware includes engineering models of the communication subsystems, a structural model spacecraft (X-1) and a full-up qualification model spacecraft (Y-1). Development tests of the communications subsystems engineering models were completed in November 1973. Structural testing was satisfactorily completed on the X-1 engineering model spacecraft in May 1975. Systems level qualification was completed in October 1975 with all critical performance specifications met or exceeded. System level qualification is designed to demonstrate design integrity and performance to specification via a series of tests including shock, acoustic, modal survey, thermal, electromagnetic interference (EMI), solar-thermal vacuum, and integrated system test. Reliability (life) tests of critical components will continue throughout the development program. The F-1 spacecraft was acceptance tested during the development program. The Y-1 spacecraft is a full configured spacecraft which will be refurbished and used as a back-up flight vehicle (F-4).

2. Operational Test and Evaluation: Test and evaluation is limited to Development Test and Evaluation (DT&E) except for payloads supporting other systems, such as Air Force Satellite Communications System (AFSATCOM), which are tested in conjunction with appropriate supported system. The AFSATCOM Final Operational Test and Evaluation (FOT&E) is scheduled for FY 1979.

3. Systems Characteristics:

- a. UHF mission characteristics
240-400 MHz
12 - 5 KHz channels, 75 BPS, two-way teletype
Anti-jam capability

- b. AFSCF Mission Characteristics
1.76 - 2.3 GHz (S-Band)
Data Pass - 256 KBs, 32 KBs

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d. Orbital life Mean Mission Duration (MMD)

Mission characteristics were validated during Development Test and Evaluation (DT&E). Operational characteristics and orbit performance of payloads supporting other systems will be demonstrated during the Operational Test and Evaluation (OT&E) of the supported system, e.g., Air Force Satellite Communications System (AFSATCOM).